



River Protection Program Supplemental Treatment Updated - DBVS Status

October 2007

U.S. Department of Energy

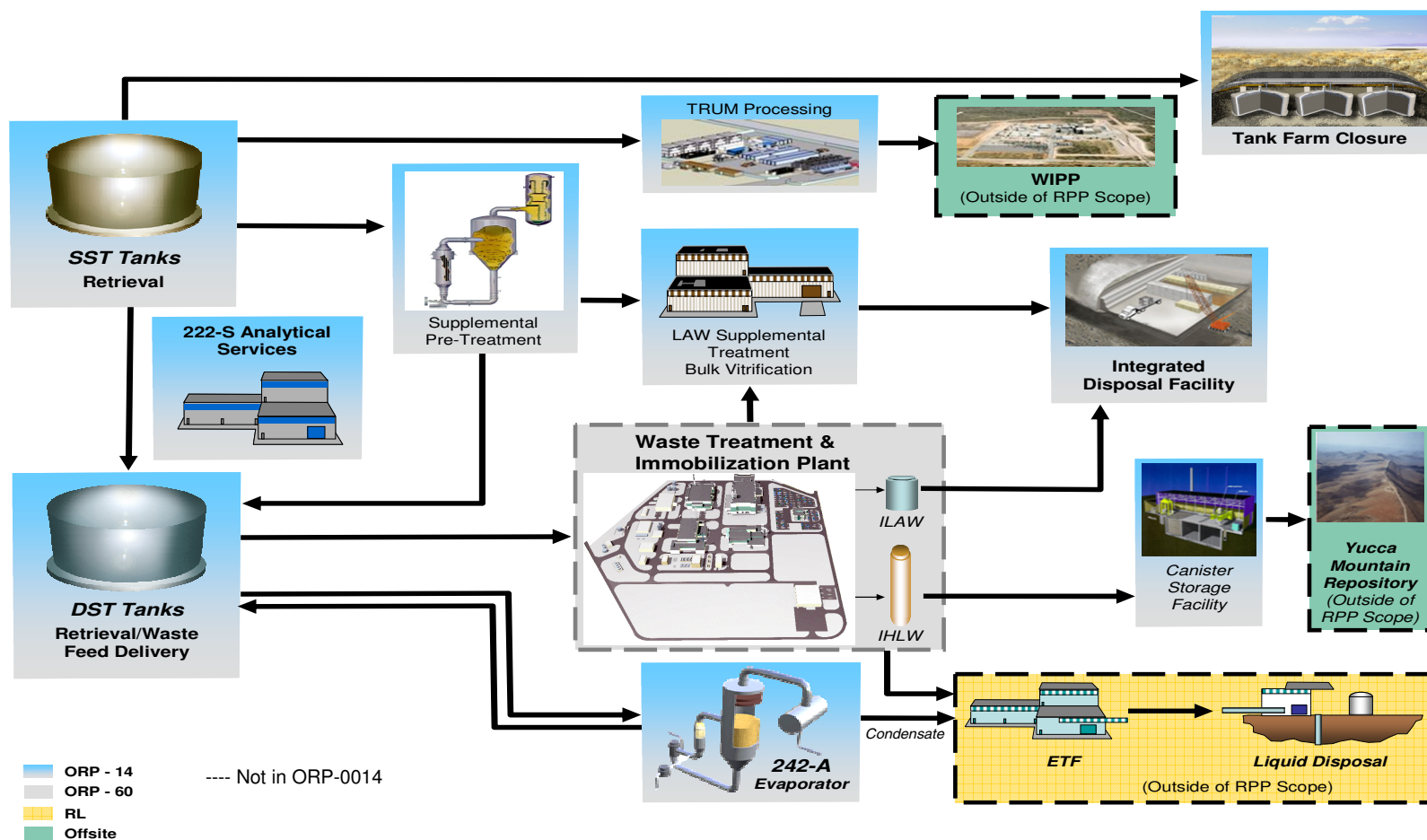


Office of River Protection

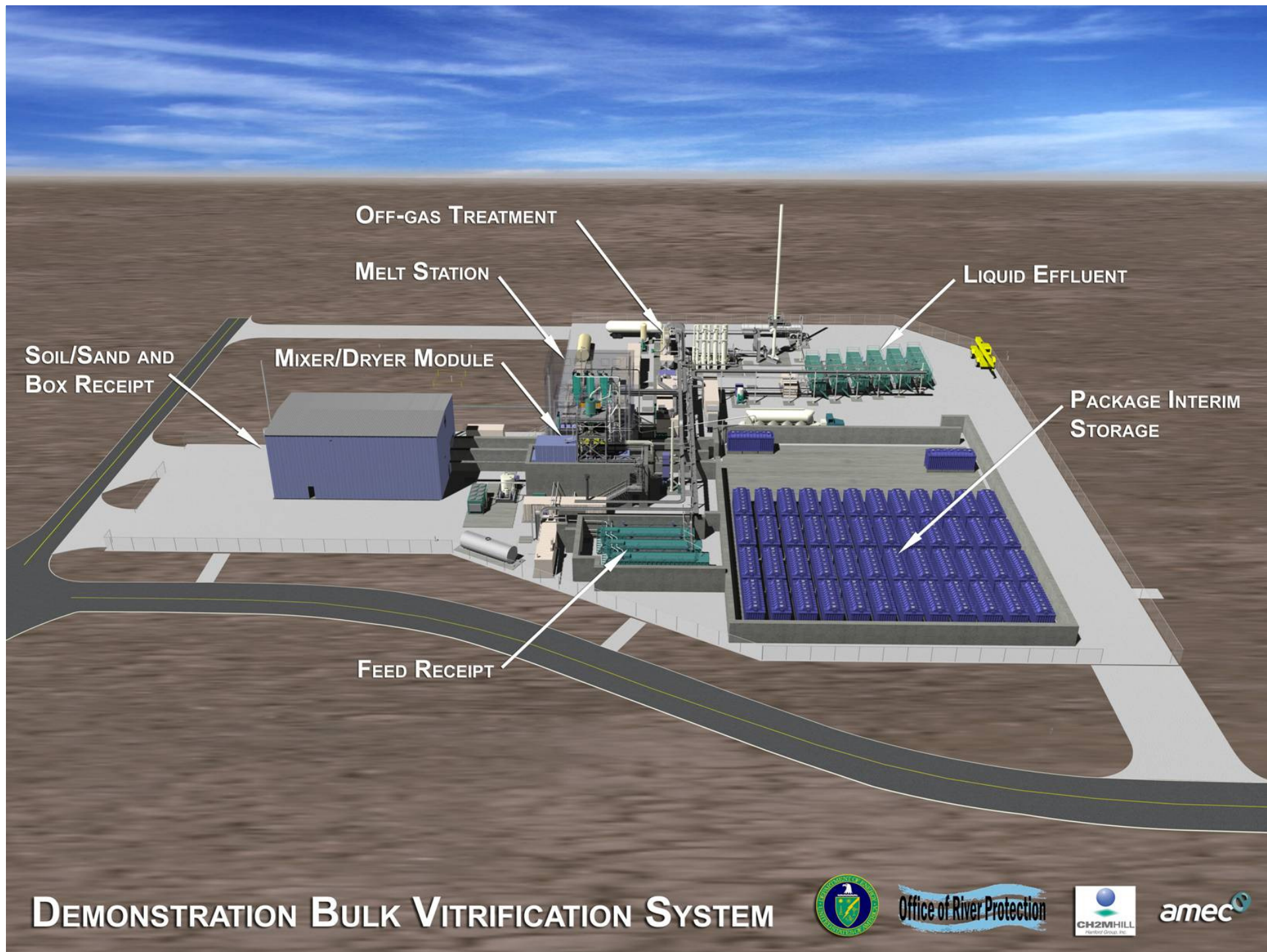


CH2MHILL

River Protection Project Mission



- 24 technologies evaluated by DOE, contractors and regulators (2002)
 - 3 selected for further evaluation (2003)
- Bulk Vitrification Research and Development selected by DOE (2003)
- Testing Program Summary Status
 - crucible - >100
 - engineering scale - 13
 - large scale tests – 8
- Project baseline design and cost estimate complete
- Resolved earlier test issues related to metal outside the glass structure (redesign of starter path and heat up rates) and glass migration past the refractory (redesign of refractory)



DEMONSTRATION BULK VITRIFICATION SYSTEM

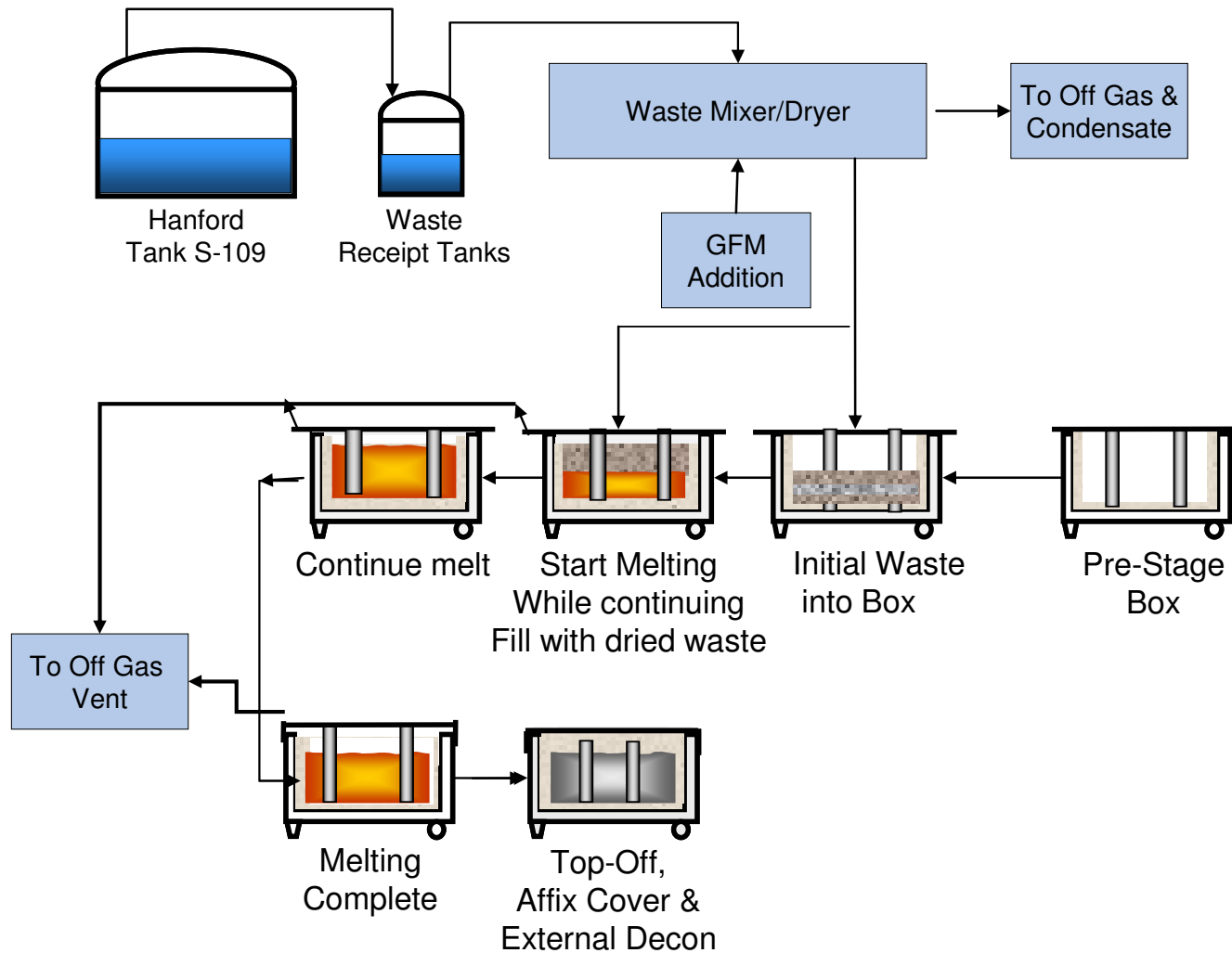


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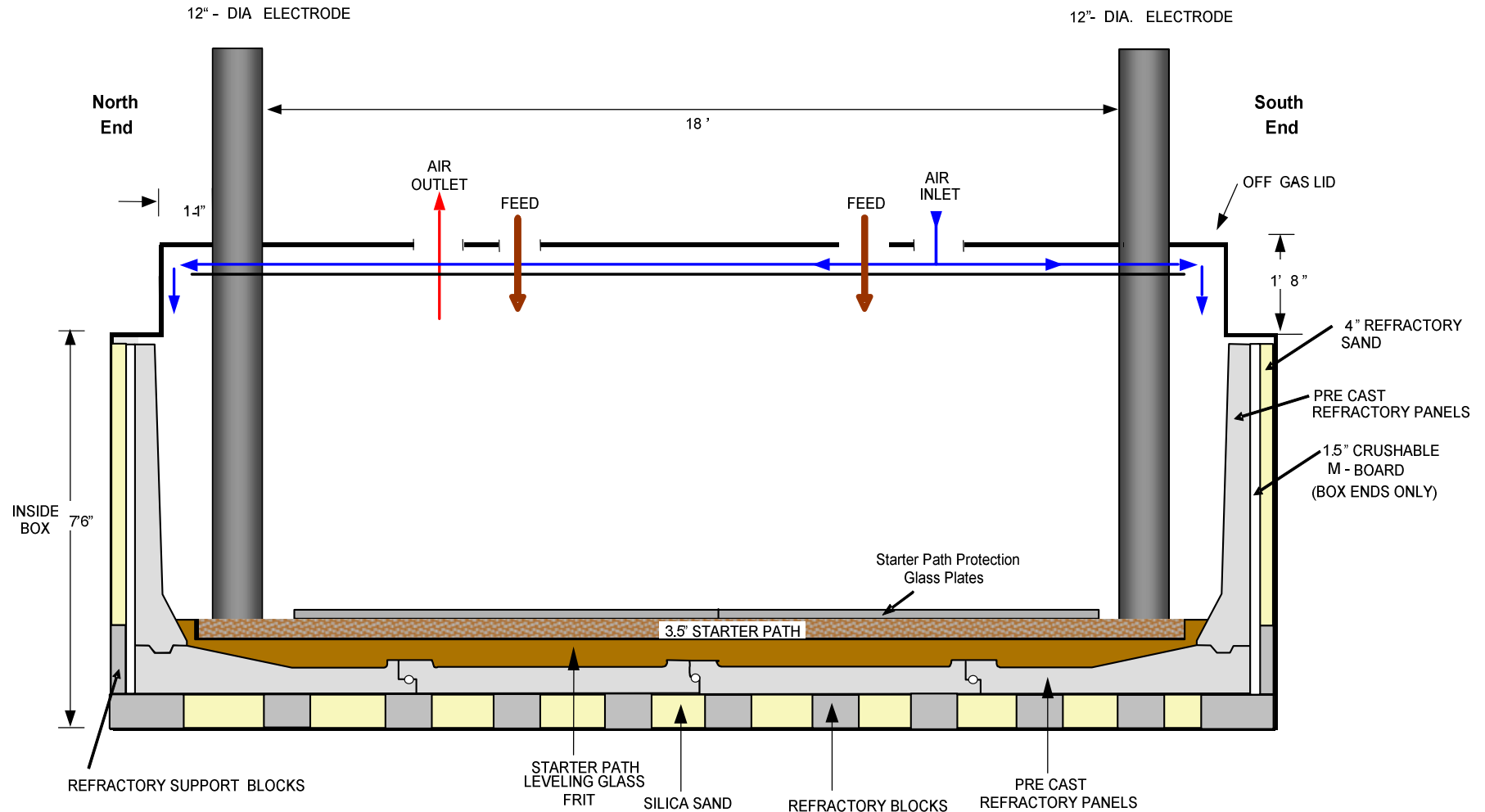


amec

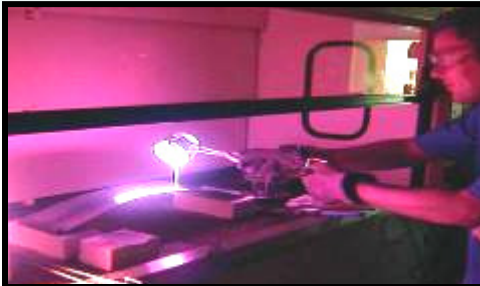
Simplified BV Flow Diagram



Melt Box



Waste Form and System Operability Testing



Crucible / Lab Scale



Engineering 1/6th Scale



Full Scale

Non-Rad	>100 tests <ul style="list-style-type: none"> ✓ Glass Formulations ✓ Waste Loading ✓ Full Range of Waste ✓ MIS Reduction ✓ Verify applicability of previous Borosilicate testing 	11 Tests <ul style="list-style-type: none"> ✓ Melter System ✓ Waste Form Performance ✓ Mass Balance (off-gas, refractory, etc.) ✓ Waste Loading ✓ 1 planned (MIS reduction) 	8 tests <ul style="list-style-type: none"> ✓ Waste Form Performance ✓ Validate Scaling = VERY IMPORTANT, scale matters ✓ System Optimizations ✓ 1 Planned <ul style="list-style-type: none"> *MIS performance *Glass Forming minerals *Cold Cap management
Radioactive	10 tests, actual waste <ul style="list-style-type: none"> ✓ Glass Formulations ✓ Waste Loading ✓ Re / Tc behavior 	2 tests, 1 actual tank waste <ul style="list-style-type: none"> ✓ Waste Form Performance ✓ Mass Balance <ul style="list-style-type: none"> - Issue: Tc99 balance 	DBVS <ul style="list-style-type: none"> ✓ Waste Form Performance ✓ Integrated system ✓ Supplemental Treatment system cost, design, and permitting
<u>Balance of System</u> -- Mixer/Dryer -- Off-Gas -- Waste Feed	10 batches @ 5L > 50 batches @ 22L Lab scale is not effective for testing these systems	20 batches @ 130L <ul style="list-style-type: none"> ✓ Mechanical Feed System configuration ✓ Auger system ✓ Feed valve 	IDMT and DBVS IDMT and DBVS IDMT and DBVS



Completed



In-Process



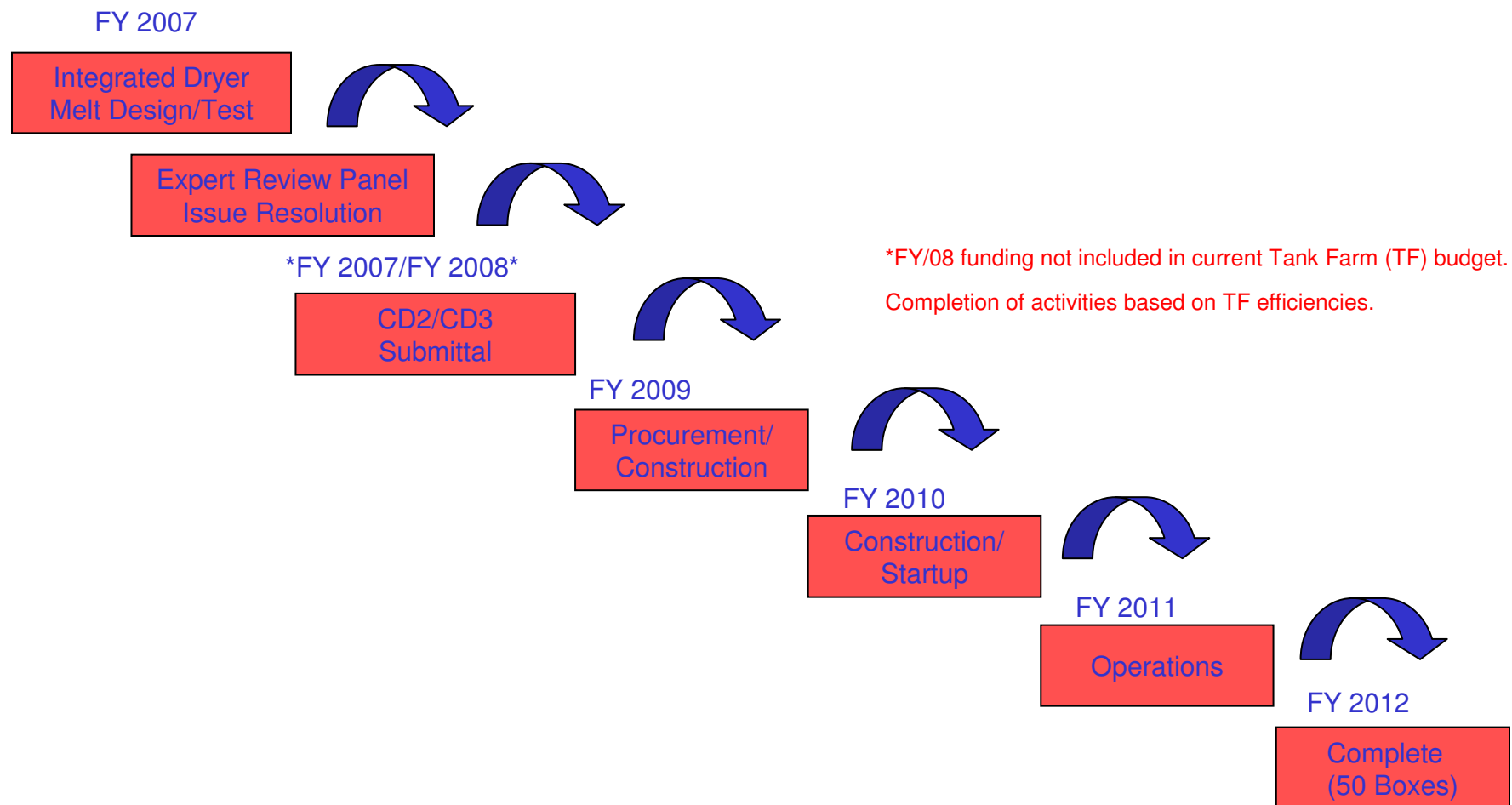
Planned

DBVS Background - Where we are today

- CD-0/1 Approved July 2006
- Technical Baseline - Expert Review Panel and EM-21 reviews complete
- Integrated testing complete – analysis on-going
- Cost/Schedule baseline review complete - awaiting close-out of corrective actions
- Revised Baseline Cost
 - Total cost: \$229.73M (including \$13.05M contingency)
 - Cost-to-date: \$99.6M
 - Estimated cost to complete: \$120.26M
- Baseline ready for CD-2 approval

Hanford Supplemental Treatment Program DBVS Project

DBVS PROJECT EXECUTION SCHEDULE



Update DBVS Discussion Topics

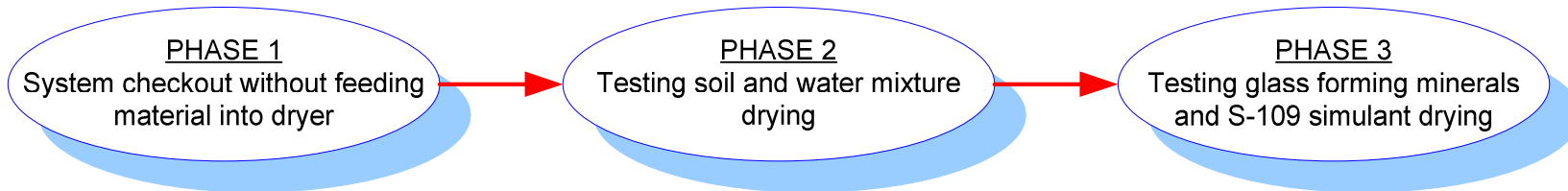
- 10,000 Liter Full-Scale Dryer Testing Results
- Integrated Dryer Melt Test Qualitative Results
- Design Modifications
- External Independent Review Status

Project Implementation Plan

- Plan complete December 2006
 - Plan addresses all Expert Review Panel issues including:
 - 19 **technical issues**, which if not corrected could result in a failure of the DBVS demonstration system (e.g. system complexity, system integrated testing, system confinement, insufficient number of cold testing campaigns)
 - 26 **areas of concern** which may result in a change to design, or may require additional testing (e.g. OGTS operability, design optimizations, facility future use considerations)
 - 13 **suggested improvements** which the project should consider to enhance safety, cost, schedule, or efficiency (e.g. evaluate continuous feed operations, dryer placement on ICV, additional compositional variability testing)
 - ~40 EM-21 recommendations which focused on Tc mass balance, cold cap management, system complexities
 - Plan review by expert panel and DOE completed in January 2007
 - Overall issue resolution acceptance, cost impact clarifications required, prioritization suggested
 - Contingency allowance to address planned actions included in September 2006 project estimate
- Final Plan approved

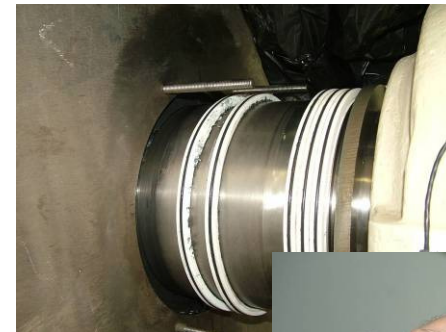
10,000 Liter Full Scale Dryer Testing

Phased Approach



Issues/Results

- Modified shaft vacuum seals from plastic lip seal to graphite packing rope for better seal longevity
- Conditioned support systems (vacuum pump, condenser, chiller, steam supply, and hydraulic power unit) and obtained system baseline data including thermal expansion
- Identified dryer mass limit that could be turned by the shaft rotation hydraulic system
- Optimized dryer sintered metal filter pulse-back settings
- Demonstrated bleed and feed operation
- Achieved minimal product criteria (e.g., moisture 3-5 wt%, greater than 50% pellets larger than 29 mesh)



10,000 Liter Full Scale Dryer Testing

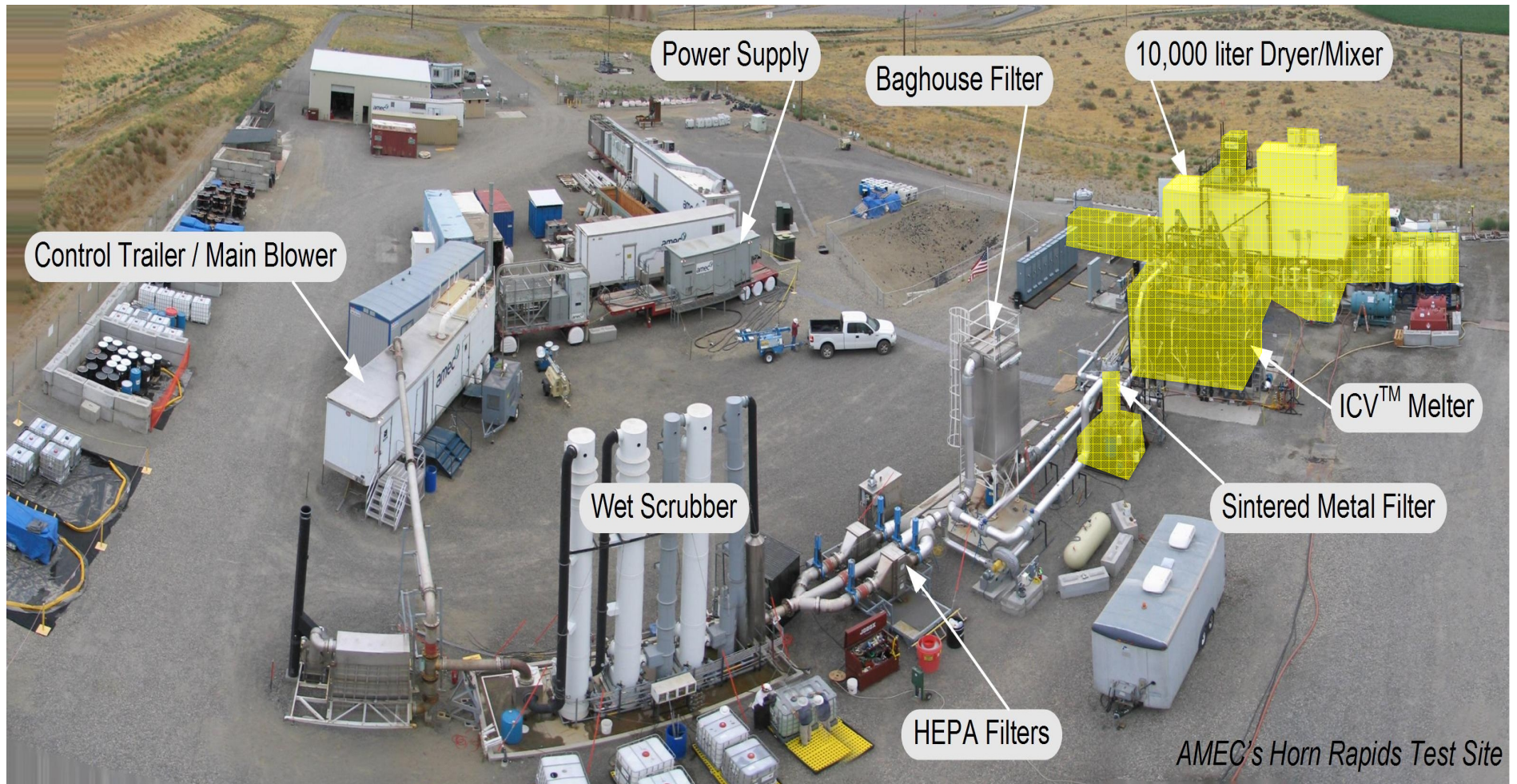
Test Objectives

	PARTIAL	MET
Dry prototypical melt feed (using S-109 simulant) while demonstrating stable moisture process control, stable dryer support system operation, and continuous/discrete liquid feed to dryer		✓
Obtain product and operating data to verify flowsheet design, and dried product assumptions		✓
Obtain dried product and dryer condensate data, including filter fines , to verify safety analysis assumptions (e.g., decontamination factor), behavior and fate of non radioactive constituents of potential concern (e.g., Re and I), and validate process flowsheet	✓	
Examine feasibility of indirect dryer product moisture monitoring (instrumentation)	✓	
Determine effects on dryer and dried product of extended (non-heated) dryer plow rotation		✓
Demonstrate viability of semi-continuous dried product discharge		✓

Conclusions and Recommendations

- Full Scale integrated testing was invaluable for DBVS design verification and operations strategy
- Dryer system performance supported test objectives
- System requires additional run time to maximize pellet formation to increase melt throughput and reduce dry material handling issues

Integrated Dryer/Melt Test Facility Layout



DBVS Prototypic Equipment

Large Scale 38D Integrated Dryer/Melt Test

- Demonstrate Integrated System Operations
- Validate Prototypic Systems Operations
- Validate MIS Mitigation
- Demonstrate Glass Product Viability

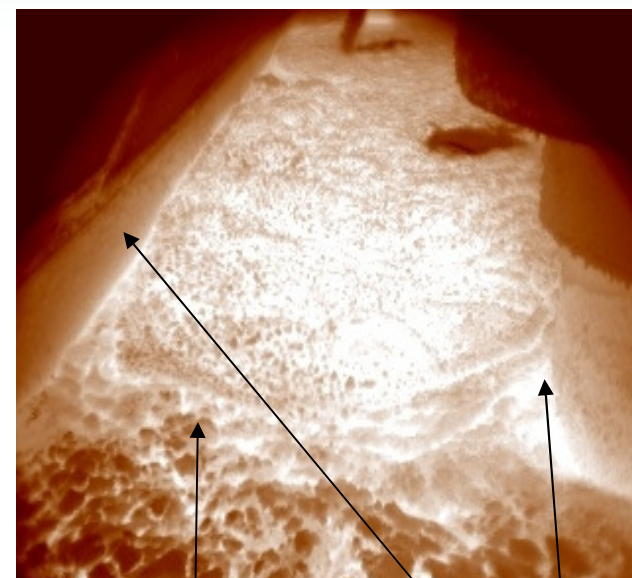
Integrated Dryer Melter Test Results Status

Objective	Success Criteria	Results
Demonstrate integrated dryer and melt system operations	Complete minimum of 20 feed discharge cycles from 10,000 liter dryer to the In-Container Vitrification	Exceeded Objective (30 feed discharge cycles)
Demonstrate resolution to the Molten Ionic Salt (MIS) issue	Estimated Tc mass in Castable Refractory Block/Sand <3.7% of total fed (based on Re surrogate) No clumped salt (field observations) No MIS penetration beyond 50% of CRB depth (field observations/Scanning Electron Microscopy analyses)	Final results Dec 2007 Objective Met: No clumped sand Objective Met: Penetration < 10% of wall thickness
Demonstrate acceptable glass product	Meet Waste Treatment Plant Vapor Hydration Test and Product Consistency Test performance specifications	Final results Dec 2007

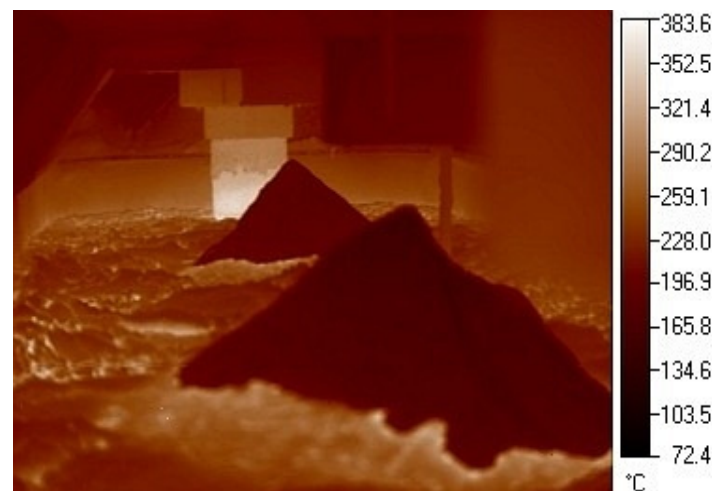
Test Run Summary

Run Stage	Details
Test Duration	Total Duration: 210.5 Hrs
Material Processed	100% of planned waste feed processed Pre-dried: 14,492 Kgs Integrated operations: 43,476 Kgs (30 feed cycles) Clean glass batch: 1,886 Kgs Total glass produced: 44,200 Kgs
Melt Temperatures Maintained	1250-1300 °C
Melt Power	300-650KW

IR Camera Image of Melt Surface
Near End of and during Test



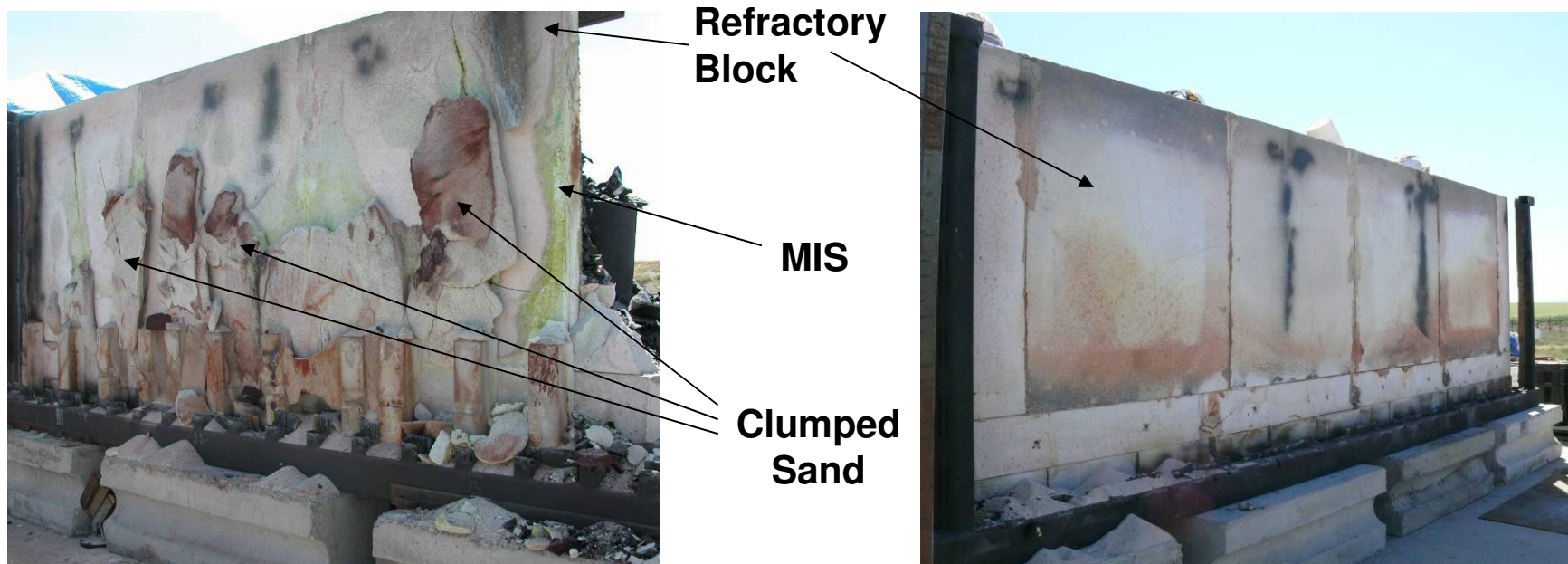
Melt Surface CRB Wall Electrode



Qualitative Results: Refractory Package

October 2006

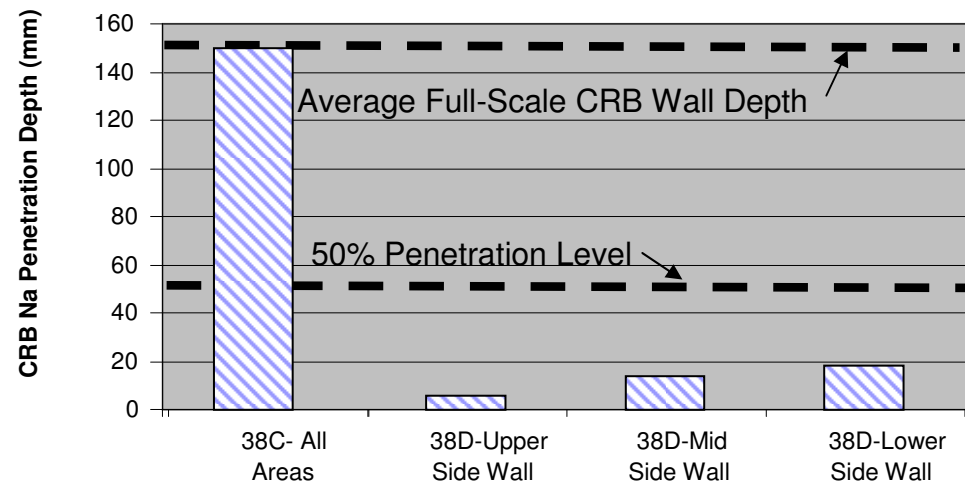
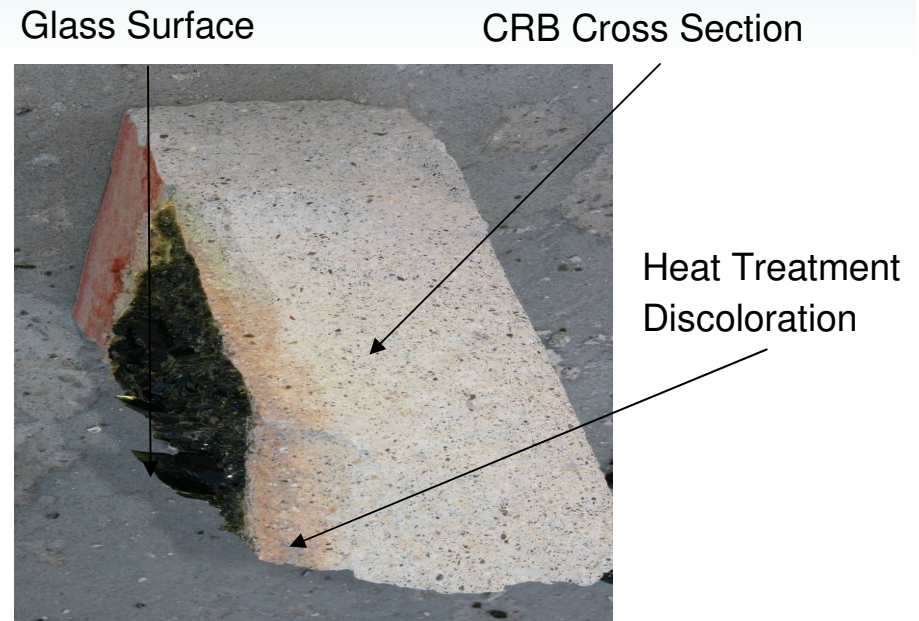
September 2007



Comparison of October 2006 to September 2007
after partial disassembly.

IDMT Qualitative Results CRB Cross-Section

- Test Objective Met
 - Scanning Electron Microscope – Energy Dispersive Spectroscopy (SEM-EDS) show Re penetration depths of less than 15% (6mm-20mm) of CRB thickness
- Qualitative results indicate MIS issue resolved
 - Quantitative Re analysis results December 2007















IDMT Qualitative Results- Acceptable Glass Product

- Glass block visually homogenous
- No unacceptable crystallization
- Low Fe metal formation
 - 38D- 526 grams
 - 38C- 536 grams
 - 38B- 730 grams
- VHT and PCT results December 2007





Risk Item	Risk Resolution	
Re / Tc in top layer		<i>Resolved in Test 38B</i> 
Iron slag formation		<i>Resolved in Test 38B1/38C</i> 
Hot Spot / Box shell		<i>Resolved in Test 38C</i> 
Cs plating on hood / pipe		<i>(EM-21) Resolved in Test 38C with cold cap management</i> 
Molten Ionic Salt (MIS)		<i>Completed crucible/ES/LS scale mitigation tests using glass forming materials/ES and FS test completed</i> 
Integrated System Test		<i>Successful dryer testing lab/engineering scale Integrated Dryer Melt Test (38D) demonstrated Feed system, drier, filter, melt, glass forming materials demonstrated</i> 

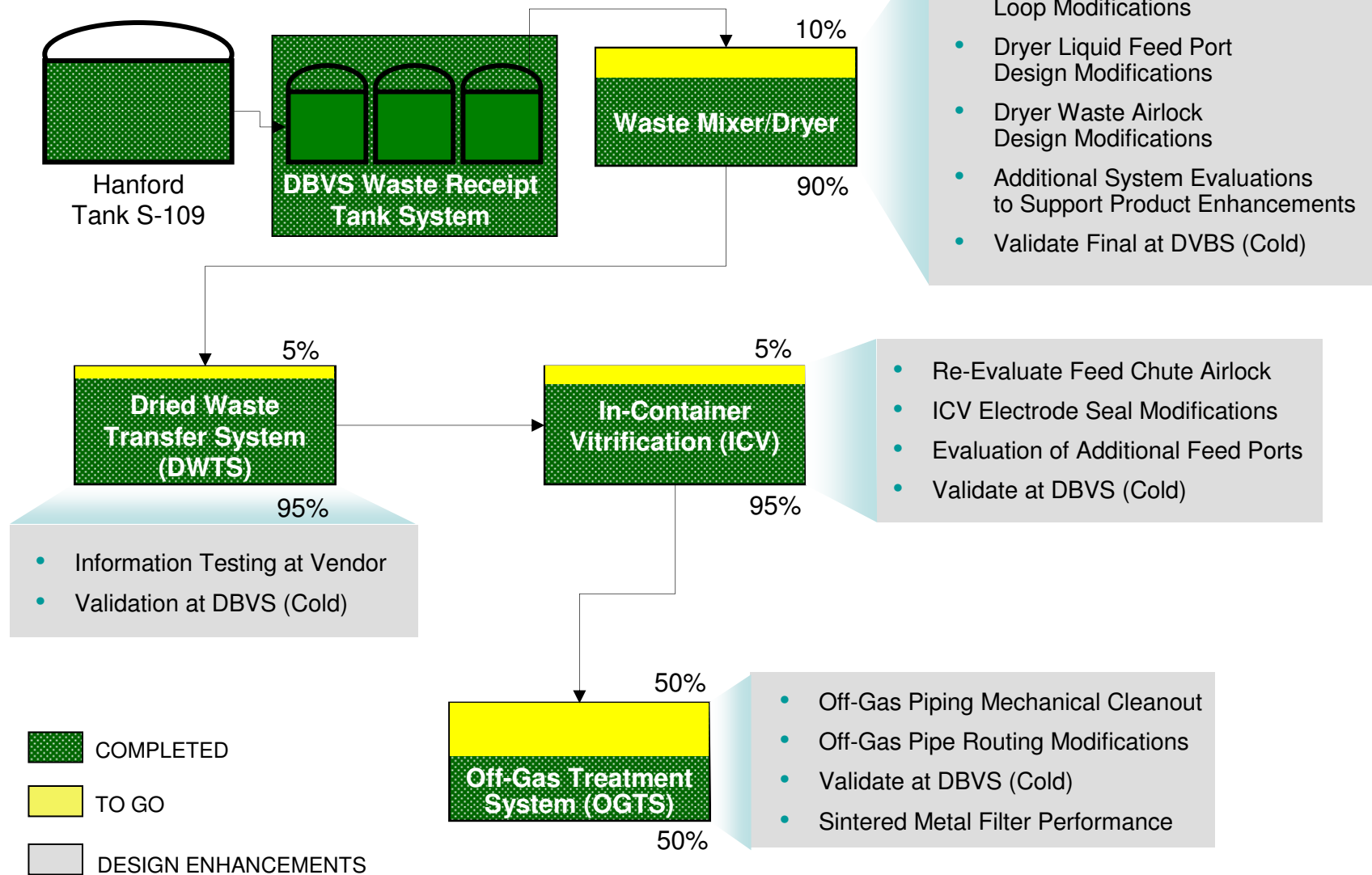
Integrated Dryer Melt Test Design Modifications

- Modify ICV off-gas pipe routing/mechanical cleanout design addition
- Revise recirculation loop waste feed to dryer with dedicated feed pump
- Modify dryer feed port(s)/dried waste feed airlock(s) design
- Additional instrumentation to improve process control (moisture/temperature)
- Modify ICV electrode seal(s) design

DBVS External Independent Review

- External Independent Review final report issued 8/20/07
- All Corrective Actions Complete for CD-2
 - 6 Open Items (programmatic in nature) to be Completed in Support of CD-3
- External Independent Review team concurs with corrective actions
- Package Ready for EM Approval of CD-2

Path Forward to CD3



Proposed FY08 Work-scope

- Complete Quantitative testing of Melt 38D
- Additional Confirmation Dryer Run Time
- Advancement of BV Waste Envelope Testing:
Initiate glass formulation testing
- Safety Basis and Design Improvements
 - Complete PDSA/Final Design
- Expert Review Advisory Panel Follow Up:
 - Reconvene Core Area Expert Review Panel Members for technical progress follow-up